SCIENCE.

FRIDAY, JANUARY 23, 1885.

COMMENT AND CRITICISM.

Dr. E. Ray Lankester writes to *Nature* of Dec. 25 a letter denouncing Koch's claims in regard to the cholera bacillus, and denying his right to any more knowledge in regard to bacteria "than that which an industrious worker may be expected to have gained in the course of very special observations in regard to a limited class of these organisms (the pathogenic class), extending over a few years." Fortunately, Koch's reputation rests upon a more solid foundation than that which is conceded to him by some English and American writers, and his work is not likely to lose any of its value by accusations of want of knowledge. The writer in *Nature* gives a very distorted diagram of various organisms, — the bacillus of glanders, the bacillus subtilis, etc., — and lays especial stress upon the fact that Koch said nothing of the comma bacillus before reaching India, and that in Egypt an entirely distinct and straight organism was claimed as the cause of cholera. This is a distinct accusation, which does not seem to us to be justified by Koch's reports. Whilst in Egypt, the German commission found several organisms, one of which might be the specific cause of the disease; but no actual proof of the fact was offered or suggested. It was because they were in doubt, that they asked permission to carry on their investigations in India; and it was only after they had reached that country, and had had opportunities for further investigation, that special stress was laid upon the comma bacillus. The case, so far as Koch is concerned, is summed up in our columns of Dec. 19, 1884. His opponents might well choose an advocate less biassed than Dr. Lankester. The *disproval* of Koch's theories must come from actual work upon the subject, and not from literary efforts.

Later reports of the work of Drs. Klein and Gibbes (the English cholera commission) in India justify their conclusions more than what we had seen when speaking of it last week. Their results are summed up in the *Gazette of India* for Nov. 28, 1884 (*Lancet*, Jan. 3, 1885), and are as follows: 1°. They find 'comma bacilli,' so called, in other diseases than cholera, as epidemic diarrhœa, dysentery, and intestinal catarrh, associated with phthisis. 2°. They did not find the comma bacilli in typical cases of cholera in any thing like the numbers claimed by Koch: they never approached the appearance of a 'pure culture' in the ileum. 3°. They did not find the comma bacilli in the tissues of the intestines, or elsewhere, as Koch did. 4°. Klein was unable to discover that the comma bacilli differed from any other putrefactive organism under cultivation. 5°. They found peculiar-shaped bacilli, very small and straight, in the mucus-corpuscles found in mucus-flakes removed from the intestine soon after death from cholera: they found these same bacilli always, even when the comma bacilli were not discovered. 6°. These bacilli do not behave in any peculiar way under cultivation, and are not to be found in the tissues of the intestines, or elsewhere. 7°. They did not find any bacteria of any kind in the blood, or in any other tissue. 8°. Many experiments gave the following results: (*a*) Mice, rats, cats, and monkeys were fed with rice-water stools, with vomitus, with mucus-flakes from the ileum, both fresh and after having been kept for twenty-four hours (the animals remained in good health); (*b*) Inoculations with recent and old cultures of the comma bacillus, and of the small straight bacillus, as well as with mucus-flakes, were made into the subcutaneous tissue, into the peritoneal cavity, into the jugular vein, and into the cavity of the small and large intestine of rabbits, cats, and monkeys; but the animals remained perfectly well and normal.

The commission hoped to conclude its labors and to return to England in December, when a detailed report of its work would be passed through the press at once. This report will be read with very great interest, for Dr. Klein's work has heretofore been excellent in its conscientiousness. It will be seen, however, that all their results are purely negative, so far as can be judged from the abstract before us; and judgment upon the work should be deferred until the evidence is all in. With Koch's positive results so recently reported, and the result of his further work still to come, the problem cannot yet be considered to be definitely settled.

Should some serious effort not be made to preserve the American bison from total extinction? To save some remnant of the vast herds of this noble animal which even a few years ago existed, some speedy and effective action is needed; and posterity will surely find a just cause of complaint against the present generation if such action is not taken. It is a mistake to suppose that extensive herds still exist in the Canadian north-west or elsewhere. Last summer a few animals made their way as far north as the Red Deer River, and scattered individuals are still occasionally found in the broken region about Wood Mountain; but it is doubtful if at the present moment there exist as many as a couple of hundred in all the plain country north of the international boundary. If any herds worthy the name are still to be found, it is in the Upper Missouri and Yellowstone region; and, judging from published statements concerning the trade in robes, these are on the verge of extinction. The preservation of an animal with the roving habits of the bison is undoubtedly a difficult problem, but should not prove an impossible one. Even if the Yellowstone Park were wholly unsuited for the permanent residence of the bison, some other naturally bounded tract might surely be found, in which a small herd of these animals might be allowed, as far as possible, to retain their natural habits and yet be protected from slaughter. A conscientious attempt in this direction would at least save us the disgrace of being found altogether supine in the matter.

While the Yellowstone Park may not afford the environment most natural to the American bison, may it not be in reality the best refuge it is now practicable to offer it? In order to preserve any number of these animals from slaughter, obviously it would be necessary to restrain their wanderings. In short, any remnant of the once numerous herds we may desire to preserve would have to be kept in an enclosed park; and this, in order to enable the animals to retain in any considerable degree their natural habits, should be of large size. It is therefore a matter that the government may very properly be asked to take in hand, it being beyond the ability or means of individual citizens. So widely scattered are the small remnants of herds which still exist, and so distant are they from convenient means of transportation, that even the procurement of a small band of from twenty-five to fifty — a less number would hardly suffice — would entail the expenditure of much time and money, and could even now be accomplished only with great difficulty, while, if delayed much longer, might become practically impossible.

A bison preserve, wherever located, would necessitate not only a large outlay at first, in securing the herd and providing a properly enclosed park, but also constant expenditure in the way of providing proper keepers. Unless some more favorable section of country, both as regards proximity to the herds and environment, can be selected for the purpose, a portion of the Yellowstone Park should at once be set aside as a bison preserve, be properly enclosed, and stocked with as large a number of bisons as it may be practicable to procure. In this way, while we should not have the bison in exactly a state of nature, we might be able to preserve indefinitely a respectable remnant in a semi-domestic state; somewhat as the Auerochs, the old-world congener of our bison, is preserved in a government park in Lithuania.

LETTERS TO THE EDITOR.

The muskrat carnivorous.

I HAVE seldom been more surprised than at the statement that the carnivorous habits of the muskrat have but just been discovered by scientific men. They are so often mentioned in treatises on American conchology, that a little reading would have prevented the error. Thus Dr. James Lewis says of the Unionidae, "They afford abundant food for the muskrat and mink;" and like quotations might be given. But the fact is not left out of sight in treatises on the Rodentia. In the 'Mammalia of New York,' published by the state, De Kay says of the muskrat, "It is also extremely fond of the fresh-water mussel (Unio), heaps of which, in a gnawed or comminuted state, may be found near their retreats." Tenney's 'Zoölogy,' a mere schoolbook, says, "Muskrats feed upon mussels, and roots of grasses, and aquatic plants." To my knowledge, they feed on Unios throughout the year, but mostly in winter and spring. The floor of my boat-house is covered with shells, left by muskrats, every spring; and I have often stopped at the heaps of shells by their holes to see what species occurred near. The fact that they eat fish has certainly been less known.

There seem to be four principal ways in which muskrats get at the animal in the mussel-shell. In a small lake near me there are very fine specimens of Anodonta fragilis, but in such situations that it is almost impossible to get the finest ones alive. The shells are large, but almost like paper; and the muskrat invariably tears off one valve. In the thicker shells of Seneca River, not far off, its common way is to break the thinner end of the shell. In the much heavier shells of the west and south, I have heard that they either gnaw the hinge-ligament, or allow the animal to freeze and open.

While speaking of the Unionidae, I may mention a curious circumstance. Very few of their shells are to be found on one shore of Onondaga Lake, which is flat and marly; and this is partly so because the animal burrows deeply in the tenacious mud, and is not easily dislodged. But I passed that shore one day when a number of Anodonta Benedictii were washed in. They were helpless in the waves; but, when they had rested a while on the beach, they got up on edge, protruded the muscular foot, got a firm hold on the marl, and worked their way back to the water with apparent ease. W. M. BEAUCHAMP.

A census of hallucinations.

In a letter which you published on Dec. 5, I mentioned a sort of census whereby we are inquiring what proportion of the population has experienced waking visions of absent friends; the object being to discover how far *chance* may account for the numerous cases where such hallucinations have coincided with the death (or some serious crisis in the life) of the person whose presence was suggested, or how far, on the other hand, these cases drive us to some such hypothesis as 'telepathy.' In a letter published by you on the same day, Professor Newcomb has objected that untrue answers may be given by persons wishing to amuse themselves at our expense. I am far from denying that persons may exist who would be glad to thwart us, and amuse themselves, even at the cost of untruth. But when the question is put, "Do you remember having ever distinctly seen the face or form of a person known to you, when that person was not really there?" it is not at once obvious whether the *amusing* untruth would be 'yes' or 'no.' In neither case would the joke seem to be of a very exhilarating quality; but, on the whole, I should say that 'yes' would be the favorite, as at any rate representing the rarer and less commonplace experience. 'Yes' is, moreover, the answer, which, as a matter of fact, it has been very generally thought we ourselves preferred; so that to give it might produce a piquant sense of fooling us to the top of our bent. But a moment's reflection will show, that, so far as the census might be thus affected, it would be affected in a direction *adverse* to the telepathic argument; for the commoner the purely casual hallucinations are reckoned to be, the stronger is the argument that the visions which correspond with real events do so *by chance*. And if the number of these coincident visions makes the chance-argument untenable, even when the basis of estimation is affected in the way supposed, *a fortiori* would this be the case if the *yeses* were reduced to their true number.

While on this point, I may add that in such a census as ours there are reasons why, quite apart from untruth, an unfair number of *yeses* are sure to be obtained. One chief reason is, that, when forms to be filled up are distributed on a large scale, it is impossible to bring it home to the minds of many of the persons whose answer would be 'no,' that there is *any use* in recording that answer. Their instinct is, that results, to be of scientific value, must be positive, like natural-history specimens. This difficulty has been encountered again and again; and I feel little doubt that the proportion of *yeses* to *noes* will in the end be quite double what it ought to be: in other words, the telepathic argument, if it prevails, will prevail, though based on data distinctly unfavorable to it.

As Professor Newcomb seemed to confine his objection to the results of the census, I need not occupy your space with a description of the various precautions by which we ascertain that our cases of *coincident* visions — of *veridical* hallucinations — are *bona fide* records. Suffice it to say, that, whatever the possible sources of error in our evidence may be, — and there are some which demand unceasing care and watchfulness, — deliberate hoaxing is a danger which we believe we can reduce to an amount that will not affect the validity of our general conclusions.

EDMUND GURNEY,
Hon. sec. of Soc. for psych. research.
14 Dean's Yard, Westminster, S. W.,
Dec. 22.

Dikes of peridotite cutting the carboniferous rocks of Kentucky.

Prof. A. R. Crandall, of the Kentucky geological survey, has recently discovered in Elliot county, of that state, several dikes of very interesting peridotite, which intersect the carboniferous formation. It very rarely happens that such youthful felspar-free, massive rocks occur in regions of so little disturbance as eastern Kentucky, and under such circumstances that their eruptive character can be established beyond question. Professor Crandall and myself, with the approval of the U. S. geological survey, hope to be able to give these rocks the careful study they ought to receive. J. S. DILLER.

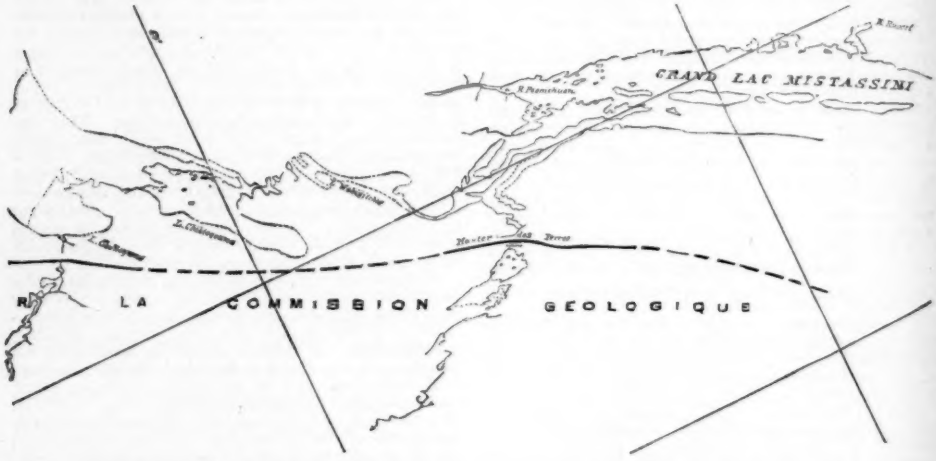
U. S. geol. survey, Washington, D.C.

Lake Mistassini.

Your contributor, Prof. J. D. Whitney (*Science*, No. 100), is quite mistaken in ascribing the recent newspaper paragraphs referring to Lake Mistassini

as having been caused by Professor Laflamme's communication to the geographical section of the British association at its late meeting in Montreal.

They commenced with a very sensational article in the *Montreal witness* dated Quebec, Nov. 17, arising out of an interview of a reporter with Mr. F. H. Bignell, a gentleman who had just returned from a trip to the Hudson Bay post on Lake Mistassini, made for the purpose of taking in supplies for the winter consumption of the party organized and despatched last spring, by the geological survey, to explore that region, and to complete the survey of the lake, which was commenced in 1870, and continued in 1871, as described in the report of the survey for those years, and of which surveys Professor Whitney does not appear to be cognizant, or of my letters to the editors of the *Ottawa free press* and the *Montreal gazette* of Nov. 17 and Nov. 25 respectively, in which the substance of the foregoing remarks was stated.



The only published map on which the result of these surveys of 1870 and 1871 by the geological corps is correctly laid down, and which Professor Whitney has probably not seen, is enitled "Carte de la Province de Quebec, Canada. Dressé au département des Terres de la Couronne, par Eugène Taché, assistant commissaire, 1880." The map is on a scale of fourteen miles to one inch; and on the face of it, in the Lake Mistassini region, we find the words 'Exploré par la commission géologique.' This map, and the report I have referred to, give the latest authentic published information about Lake Mistassini. The survey of the lake is, I hope, now in progress; and next year the size of it, and of its numerous arms, will be definitely known from actual measurement. Geologically it is a basin of flat-lying limestones, probably of lower Cambrian age, resting on Laurentian and Huronian rocks.

I enclose a tracing of the lake as it appears on the Quebec crown-lands map. The latest general map of Canada is that published in 1882 by the Department of railways and canals, Ottawa. I have not seen the Arrowsmith-Stanford map of 1880; but, in the recent maps I have referred to, the position of the lake is nearly half a degree west, not east, of that assigned to it in the geological survey map of 1866, while its outline is also very different. That it consists of several almost separate lakes, as described by the old explorers, is, I think, certain; but the assumption that there is a body of water in any way comparable to Lake Superior is exceedingly improbable, and not warranted by any recorded observations.

Alfred R. C. Selwyn,
Director, geological survey of Canada.

Lava from the new volcano on Bogosloff Island.

Three specimens of the lava which was erupted from the new volcano on Bogosloff Island, Alaska, in October, 1883, were sent by Sergeant Applegate, the signal-service observer at Unalashka, to the central office in Washington, and referred to the U. S. geological survey for investigation.

It is gratifying to note that an examination of these specimens has verified to the fullest extent the hypotheses made concerning the source of the volcanic sand which fell at Unalashka, Oct. 20, 1883, and the mineralogical composition of the lava from which it originated. The facts noted in Mr. Applegate's letter of information render it altogether probable that the volcanic sand came from the new volcano on Bogosloff Island, and a comparison of the sand with lava from that place removes all doubt.

The members of the party from the Corwin sank almost to their knees in soft ashes; and other facts, already published in *Science* (Nov. 7, p. 432), indicate that a considerable portion of the new mountain may be composed of ejectamenta. It has been stated upon the authority of Lieut. Stoney, I believe, that "the mass of the volcano was found to be a species of sand-rock, with large black rocks scattered about the crust. No traces of lava, and but small quantities of pumice, were found." Whether the 'large black rocks' referred to are portions of lava-streams projecting through the coating of sand and lapilli, or large ejected fragments, is difficult to conjecture. We are led to believe that the specimens received were taken from such masses. Through the courtesy of Mr. Merrill, I have been able to compare

the specimens sent by Sergeant Applegate with those collected by Lieut. Stoney, and found them to be the same, hornblende andesite.

When we compare the lava from Bogosloff with the volcanic sand which fell at Unalashka, we find them identical in mineralogical composition. Both are composed of triclinic felspar, with prominent zonal structure, augite, hornblende, magnetite, and groundmass, with microlites and a small proportion of amorphous matter.

Dr. T. M. Chatard, of the geological survey, made a partial analysis of the volcanic sand from Unalashka as well as of the lava from Bogosloff. The former contains 52.48 %, and the latter 51.65 %, of silica. Fearing that an error had been made in the analysis of the lava, Dr. Chatard repeated the determination, and obtained the same result. That the percentage of silica contained by each should be nearly the same, can be readily understood; but that the lava should contain less than the volcanic sand which is composed of the same material, apparently with a larger proportion of basic minerals, was unexpected. Hornblende-andesite lavas rarely occur with such a low percentage of silica, and in this respect the one from Alaska is closely related to those in the Siebengebirge and Hungary. It is evident that the felspar contained must be very basic, probably anorthite. The optical properties of the felspar point in the same direction for the angle of extinction when symmetrical is over 30°. Hypersthene, which is such an important constituent of the lavas in the Cascade Range, has not been discovered in any of the lavas yet examined from Alaska.

J. S. DILLER.

U. S. geol. survey, Washington, D.C.

Action of pollen on seed-coats and pericarps.

I am confounded by a statement, given as if of a well-known fact, which I read in the 'Science bulletin' of No. 101. At a meeting of the Academyof natural sciences, Philadelphia, Dec. 16, —

"Mr. Thomas Meehan called attention to an ear of Indian corn received from Mr. Landreth, the grains on one side of which were of a rich brownish-red color, while those on the other side were of the usual pale yellow tint. On the boundary-lines several of the grains were partly red and partly yellow, thus proving that the result was not the effect of cross-fertilization, as had been asserted in other instances of change of color. It would indeed be strange if corn were the only plant in which such change of color was produced by cross-fertilization; *yet in the case of no other species had any such change been observed.*"

The sentence I have italicised is the confounding one. It is hard to believe that such a veteran horticultural editor and copious writer as Mr. Meehan is not acquainted at first hand with some of the horticultural literature upon this curious subject (extending from the year 1729 down to our own days), and which asserts that in various instances just such change has been observed. It is harder to believe that a writer who has shown such a critical familiarity with Mr. Darwin's writings should have entirely overlooked a section in chapter xi. of 'Variation under domestication,' vol. i., beginning on p. 397, in which the principal observations (convincing to Darwin's mind as to the facts) are brought together, and the sources referred to. One wonders how the fact that some of the grains of corn were party-colored in the case described, *proves* 'that the result was not the effect of cross-fertilization,' party-coloration in the flowers being a well-known effect of cross-fertilization, according to good authorities.

A. G.

THE PEABODY MUSEUM AT NEW HAVEN.

THE Peabody museum in New Haven stands on the corner of Elm and High streets, just without the *campus* of Yale college. Like most buildings devoted to science in America, it occupies only a part of the large lot, — a fact not designed to typify the unfinished state of zoölogy, but merely resulting from lack of funds. In the present case there would, perhaps, have been no building at all, and the collections, had any of consequence been accumulated at Yale, would have remained stuffed into garrets and cellars, had not the philanthropic George Peabody given a sum of money, in 1866, to erect a house for them. Thanks to the financial prosperity of Massachusetts, the bonds for a hundred and fifty thousand dollars had greatly increased, and those set aside for the first wing of the building had become worth a hundred and seventy-five thousand dollars when the trustees began to build. With that sum they have erected one of the finest buildings, for its purpose, in the United States, — a lofty and ornamental structure of red brick and cream-colored stone, whose broad and numerous windows express the desire of the investigators within for all the light they can get.

Let us begin our survey at the bottom. Entering the basement-door, a blind man, or at any rate a blind naturalist (if such there be), would know where he was by that smell of old alcohol with which biologists are so familiar. It is safe to wager, ten to one, that every visitor to these lower regions will remember and quote a certain line from 'The tempest,' act ii. scene 2.

This pungent odor rises chiefly from the possessions of the U. S. fish-commission, deposited for sorting and examination under the eye of Prof. A. E. Verrill, who is chief of the zoölogical part of the museum, or by some of his associates. Duplicates of these submarine and littoral specimens, secured in the government's deep-sea dredgings, go to Professor Verrill, and large quantities deposited by him in the museum have been arranged for exhibition.

In another part of the basement, Prof. O. C. Marsh keeps 'greate store' of fossils, cleaning the gigantic bones from Rocky-Mountain quarries preparatory to study and display. Considerable paleontological property of the U.S. geological survey is under inspection here also. A score of expert helpers, with Oscar Harger as chief of staff, assist; one of whom

has a little building to himself, where he is constantly employed in making restorations and casts of novelties, which are distributed with great liberality.

Only favored visitors go to the basement, or care to go. The public entrance is above, opening underneath a magnificent rose-window into a spacious court with tiled floor, and walls of variegated bricks. This region is garnished by great slabs of the celebrated footprint sandstones from the Connecticut valley, and a huge stump taken entire from a coal-bed. Iron staircases, clinging to the wall in spiral flight, lead to the top story, and the court is roofed with glass.

On the right and left of the entrance are doors leading to business offices, the blow-pipe laboratory, and the lecture-rooms of the Professors Dana (father and son), where large audiences frequently gather to hear the instruction designed for undergraduates alone; and in the rear of the court, on the ground-floor, is the exhibition hall for minerals, of which the museum possesses an almost unrivalled collection. This might be expected, considering the men — Dana, Silliman, Brush, and others — of whose labors it is the result.

To mention half of the notable minerals here, would exhaust the space set apart for the whole of this article. There were formerly several thousand dollars' worth of diamonds in one of the cases; but on account of their theft, though they were afterwards recovered, the labels now state that the present specimens are glass facsimiles. The only thing in this room not locked up is a meteorite weighing sixteen hundred pounds. The metal in one spot has been sawed off, and polished until it looks like burnished steel, and has been engraved with an historical inscription, from which it appears that this meteorite fell in Texas, presumably the only state in the Union large enough to receive it safely. In an adjoining case are a peck or so of small meteorites, picked up within a narrow area of Iowa, and of suitable size to be rained down upon a more thickly settled region.

After the brilliant and many tinted ores, the endless variety and beauty of the quartz crys-

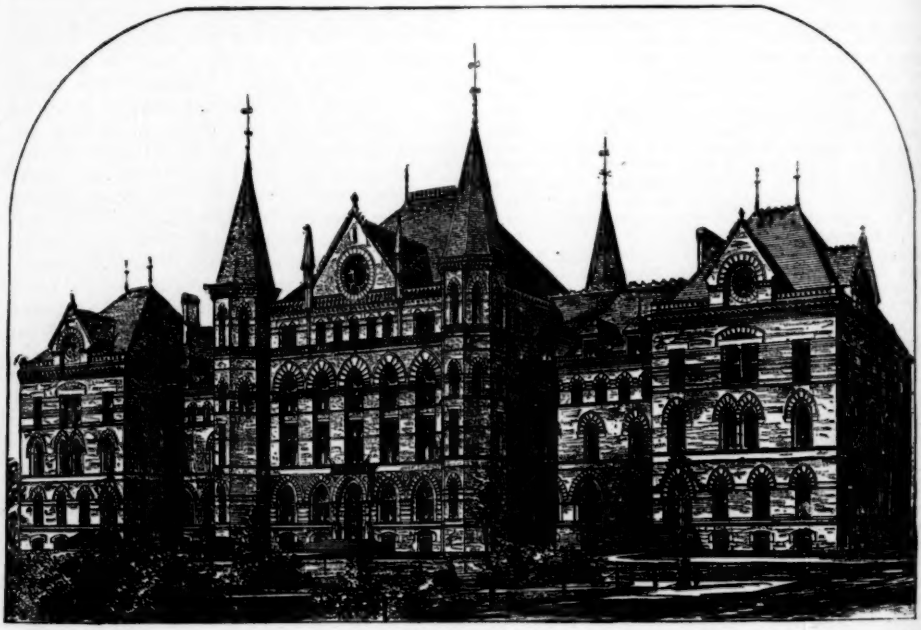


Fig. 1. — The Peabody Museum as it will appear when completed.[1]

[1] The right-hand third is already constructed.

tals, and the substantial interest inspired by the metals, visitors always pause with new gratification before some curious rosetted crystals of a form of lime; and a look of deep wisdom comes into their faces as they read the label. "Ah!" they exclaim, "I told you so. These are imported. I knew there could be nothing so pretty as that on this side. They do these things better in France, you know." And so they pass out, usually quite overlooking the 'educational series,' which has been spread with such pains for their instruction.

FIG. 2. — WIRES FOR MOUNTING MUSEUM SPECIMENS.

a, wire twisted so as to form a shoulder to prevent the specimen from slipping down; *b*, wire with the end bent around a disk of leather to which objects can be glued; *c*, a similar wire bent to fit inside a spiral shell, as in fig. 6; *d*, spiral label-holder used as in fig. 3.

This educational collection, which seems to be extremely apt and well selected, concentrates in a single case a practical glossary and text-book of mineralogy. To this epitome of the science all the rich and rare examples in the wall-cases are only attractive illustrations; and, the further to help the inquirer understand them, several copies of Dana's 'Mineralogy' will be found upon little tables near by. Here persons may sit and read, acquire and carry away the information, but not the *book*, for that is chained to an iron pillar.

The third floor is that most popular with the public, since it is devoted chiefly to modern animal life. The first thing to strike the eye in the south room is a fine series of comparative skeletons of primates, from civilized man down to the humblest of monkeys, all hanging in a beautiful row by hooks screwed into the tops of their heads. The set is usually spoken of as Professor Marsh's sunday-school class, but an unprejudiced mind can see that really there is no truth in this irreverent comparison. Beyond them, the whole side of the room is filled with cases containing an orderly succession of skeletons illustrating all the vertebrate orders; while the centre of the room is occupied by the skeletons and stuffed hides of the larger mammals, like the camel, rhinoceros, a very dejected polar bear, etc.

In the same room several cases are filled with stuffed skins of mammals, birds, and reptiles. Beside most of the land birds are placed their nests, with the eggs; or else the eggs are glued upon upright tablets of ground glass, in which position they show to excellent advantage. One large case is devoted to a collection of New-England birds alone, excellently mounted upon the branches of a tree. This is the work of Prof. W. D. Whitney, who, before he became prominent as a linguist, was known as a good ornithologist; as, in fact, he still is.

Passing to the west room on the same floor, one sees invertebrate preparations most attractively displayed. They are confined almost wholly, however, to the crustacea, mollusks, radiates, and marine protozoa. Of insects there is a very small showing, — only enough to represent scantily the classification of that immense class. This is partly because it is unwise to display insects freely, since exposure to the light causes their colors to fade, but is due chiefly to lack of material, owing to the fact that no entomologists of note have been especially interested in the progress of this museum.

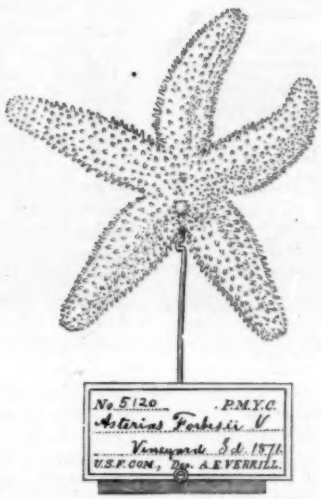


FIG. 3. — STAR-FISH MOUNTED ON WIRE FASTENED IN A BLOCK OF WOOD, WITH HOLDER AND LABEL OF THE USUAL PATTERN.

On the other hand, the special tastes of Professors Verrill, S. I. Smith, J. H. Emerton, and others, and the intimate relations the museum (through these gentlemen) has sustained with the Smithsonian institution and the U. S. fish-commission, have brought the department

of marine invertebrates to an almost unrivalled perfection. Case after case, all splendidly lighted, of rare and brilliant shells from every part of the world, vie with one another in attractiveness; while a magnificent series of crabs, sea-urchins, star-fishes, worms, corals, corallines, hydroids, and sponges, illustrates the classification, and exhibits the vast variety, of more lowly life alongshore and on the bottom of the deep sea.

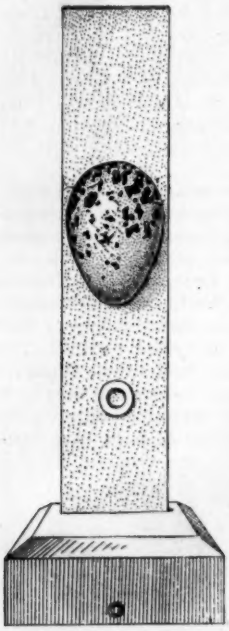


Fig. 4.—Bird's egg glued to a strip of ground glass standing upright in a wooden block.

(To make the attachment stronger, a leather ring is first glued to the glass, as seen in the figure on the lower part of the strip; and to this the egg is fastened.)

In no room does the casual visitor linger longer than in this one; while its contents are unusually interesting to specialists, because of the large proportion of type-specimens included. In many instances these are unique; as, for example, some of those beautiful orange and scarlet gorgonias or 'sea-fans,' — flat, branchless, mossy growths of calcareous matter, which resemble great masses of pressed seaweed. One case is wholly filled with these corallines; and it is doubtful whether any museum in the world can make a better showing of them.

The corals, also, are very fine, embracing many rare and even unique forms, as might be expected, remembering Prof. J. D. Dana's labors in that direction; so that only the Museum of comparative zoölogy equals this part of the cabinet.

In the way of deep-sea forms of crustaceans, and echinoderms also, a great number of novel species are publicly displayed, which were procured in recent dredgings by the fish-commission. Among them stand large jars holding alcoholic remains of the giant cuttlefishes upon which Verrill has written so many learned pages; and overhead hang Emerton's paper models of Architeuthis and a huge Octopus, which half the visitors take to be real devil-fishes stuffed, and gaze at with fearful curiosity.

The system of mounting dry objects of small size, adopted here, is perfect. It consists in using a small standard of wire set in a block of wood sufficiently firm to stand upright with security, upon the top of which (that is, on the tip of the wire) the specimen is fixed in any attitude desired by means of a bit of leather or cork glued to it at some inconspicuous point (see figs. 4–7).

In the case of shells, this produces a singularly handsome effect. They are poised upright, and can be viewed from all sides without handling, while the label attached to the foot-block is neither hidden by the object, nor hides it. The wires, often requiring much ingenious twisting and looping to adapt them to the needs of the irregular specimens and positions, are of brass; but, after each piece has been bent into the proper shape, it is silver-plated. The crabs are mounted in an equally attractive and accurate manner, these brittle and otherwise difficult preparations being treated by a combination of the method described above, with the twisted-wire arrangement familiar to osteologists. Upright tablets of ground or colored glass, to which specimens are glued, are also made use of for many objects. Here, too, as in the vertebrate hall, there is a synoptical collection of the invertebrates of New England, instructively epitomizing the local fauna.

Fig. 5.—Spiral shells glued to a strip of wood, painted black, fastened by a pin in a wooden stand.

The remaining rooms on this floor are occupied as laboratories or lecture-rooms by Professors Verrill and Smith of the Sheffield scientific school.

The fourth story contains storerooms filled with fossils; a collection (on exhibition) of about two thousand antiquities of great value from Central America; and a fair show of archeological relics, the most notable part of which is the pottery from the mounds of the Ohio valley.

But the glory of the Yale museum is its paleontological treasures, brought together wholly

by Prof. O. C. Marsh. The few representatives of this collection visible in the second-floor rooms and in the hall-ways are alone sufficient to stamp the museum as pre-eminent in this line; but they are merely an advertisement of what cellar and attic contain. It is not too much to say, that in respect to vertebrate paleontology (outside of fishes), this museum is not surpassed in the world. Where other collections own fragments or single skeletons, Professor Marsh boasts scores or hundreds of individuals, while many extinct races are known only by their fossil remains in his possession.

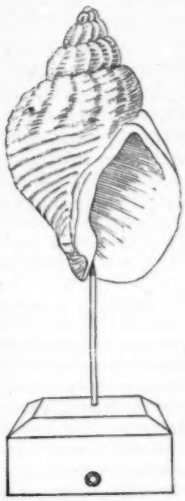


FIG. 6. — SPIRAL SHELL MOUNTED ON A WIRE LIKE FIG. 2, *c*, GLUED INSIDE, AND STANDING UPRIGHT IN A BLOCK OF WOOD.

This is the result of wisely directed energy, and the ability to spend money promptly and liberally. Marsh's frequent expeditions to the far west are well known to geologists. Many carloads resulting from these were not only shipped home by himself, but his agents have been forwarding enormous quantities ever since, from Wyoming and Colorado 'quarries.' Just before the holidays, a single instalment of two hundred and seventeen large boxes filled with bones from the western tertiaries arrived at the museum, and were stored in the basement lobby for lack of space in any apartment.

In respect to mammals, a series of fragmentary remains, chiefly jaw-bones from the eocene, represent the first primates, cheiropters, and marsupials discovered in North America. No more popularly interesting deduction is likely to be drawn from a study of them, than that which traced the genealogy of the horse from the diminutive five-toed progenitor of the early eocene to the present friend and servant of mankind. There are hundreds of specimens of these little horses at Yale.

In the class of birds, still rarer treasures may be catalogued. Along the eastern foot of the Rocky Mountains, certain strata of the middle cretaceous period have been exposed, corresponding to Meek and Hayden's 'Number three,' but termed 'Pteranodon beds' by Professor Marsh. These beds consist of fine yellow chalk, well adapted to preserving the remains of delicate structures; and here were gathered the skeletons of those remarkable 'birds with teeth' (Hesperornis and Ichthyornis), upon which Professor Marsh has published an elaborate memoir. These were collected during his expeditions of 1870, 1871, and 1872, under the greatest perils and hardships; and they have gradually been added to, until now the museum contains a hundred or more individuals, including twenty species of nine or ten genera. There are fifty specimens of Hesperornis alone. Several of the most perfect of these are on exhibition; and, as any intelligent person can comprehend their peculiarities, they never fail to interest thoughtful visitors.

Another fossil, appealing strongly to popular fancy, is the fine pterodactyl, — that same 'first specimen brought to light' which showed the bat-like flying membranes attached to the wings and tail. This came from Europe, where these winged lizards are so great a rarity in museums, that a fragment of one is highly prized; but Marsh now possesses from American rocks no less than six hundred individuals. Some are of great size, spreading wings that measured from fifteen to twenty-five feet from tip to tip. These huge pterodactyls form the new order Pterodontia, and their remains were

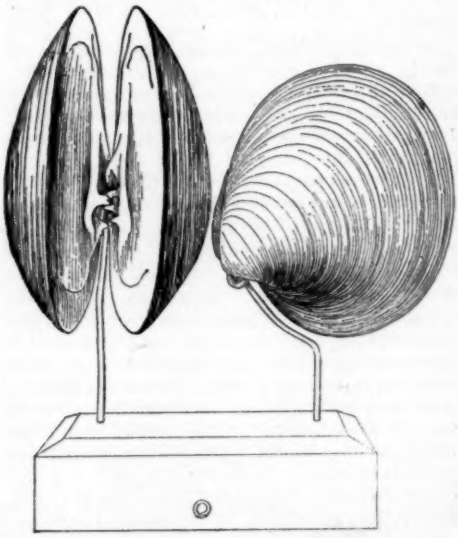


FIG. 7. — BIVALVE SHELLS MOUNTED ON WIRES GLUED BEHIND THE HINGE.

gathered in the same middle cretaceous strata of 'western Kansas' referred to a moment ago.

Prized more highly than even these, however, are the hundreds of skeletons, or parts of skeletons, of gigantic walking and swimming reptiles, herbivorous and carnivorous, which inhabited the cretaceous ocean, and basked upon the shores of the islands of that age, now forming the heights of the Rockies.

Among the earliest were disclosed wonderfully preserved bones of the class of mosasauroid reptiles, — a group, which, though rare in Europe, here attained an enormous development, both in numbers and in variety of forms. Nearly seventeen hundred individuals, of this kind of giant-reptile alone, stand on the museum's catalogue.

The land-forms were even more terrible to the imagination, though their food was vegetable, and their disposition probably peaceful. One such sauropodan dinosaur shown to the public was sixty feet in length, and in general form came nearer to a crocodile than any thing else. A thigh-bone, lying in an exhibition case, measures six feet in length and is solid; so that it was well able to support the weight of the monster as it rose, kangaroo-fashion, on its hind-legs, to browse its food or to look about it.

In another colossal reptile (Apatosaurus) of nearly equal proportions, one of the neck-vertebrae is shown which is three and a half feet in diameter; while the ponderous bones of Brontosaurus prove, that, when living, the animal must have weighed twenty tons or more. The smallest part of it is the head; the skull and brain being more diminutive, in proportion, than in the case of any other animal now known. It had no weapons of offence or defence, nor even any armor; but in another genus (Stegosaurus) approaching it in bulk, though of more compact form, the body was protected by massive plates, and armed with long spines. This exaggeration of a cross between a snapping-turtle and a hedge-hog possessed a singularity in structure, since in one of the vertebrae of the haunch is a large nerve-cavity, which contained a second or posterior brain, supplementing the extraordinarily small nerve-centre in the skull. This feature has no parallel in the animal kingdom.

To Professor Marsh's personal collection somewhat has been added at the museum by the U. S. geological survey, which will become the publisher of the outcome of his studies now in progress. A score or so of assistants are constantly on duty, either in study, or in the mechanical work of skilfully extracting fossils from the rocky matrix; in matching and mounting by the aid of wire, clay, and plaster, for permanent preservation, the often badly broken bones of some antique brute whose extinction most of the world can accept with resignation; or in making casts, models, and drawings of fossils, original and 'restored.'

Several quarto volumes are already under way; and scarcely an issue of the *American journal of science* appears, without an advance note of some special discovery in vertebrate paleontology, anticipating the completer descriptions to be made from this museum's rich materials.

Ernest Ingersoll.

RIVER-POLLUTION IN ENGLAND.

After a delay which is much to be regretted, the English government has printed the reports left by Dr. Angus Smith on the working of the Alkali-works regulation act and the Rivers-pollution prevention act. As we mentioned at the time of Dr. Smith's death, he attached great importance to his examination of polluted waters. Great improvements have been effected in lessening the injurious vapors from chemical works. The new works registered are engaged chiefly in the manufacture of sulphate of ammonia and chemical manure. The smaller gas-works have found that they can more profitably manufacture and sell sulphate of ammonia than send their gas-liquor to a distance. The directions in which improvements have latterly been most marked have been in the treatment of sulphuretted hydrogen evolved in the manufacture of sulphate of ammonia, and in the washing of the gases evolved in the treatment of coprolites and other materials at the chemical works. In the former case, oxide-of-iron purifiers have been erected as the best means of preventing the escape of sulphuretted hydrogen; and in some works this gas is now completely burned, instead of being allowed to escape unburnt, up the chimney, as formerly. At others, Claus's method of burning so as to form sulphur, which is collected, and not sulphurous acid, has been adopted. Dr. Smith maintains, that, whatever process be used, the limit of sulphurous acid allowed to escape should not exceed five-tenths of a grain per cubic foot, including the acidity of the coal-smoke itself, which latter varies from a quarter to half a grain. The escapes from sulphuric-acid works have been considerably reduced, in consequence of the introduction of regular testing by manufacturers; and condensers to absorb the nitrous fumes have been put up in a number of nitric-acid works.

Dr. Smith's new method of testing with sugar the amount of organic activity amongst the microbes (at least, of a certain class) which exist in waters was mentioned nearly a year ago in the technical journals. He found that in nearly all natural waters sugar ferments, and hydrogen gas is then given off. So far as

natural waters are concerned, he found the giving-off of hydrogen to be an indication of the presence of microbes, and that the quantity in which the gas is given off appears to increase with the impurity of the water. Thus the waters on the uplands of Derbyshire give off less hydrogen when sugar is added than the same waters taken lower down in the valleys, where sewage enters the brooks. The addition of phosphate to the waters had a powerful stimulating influence; and as the examination of a soil for phosphate is a rather tedious process, and the condition of the phosphate a point difficult to examine, Dr. Smith suggests that his hydrogen process may prove useful in the discrimination of rich and poor soils; also it is a test of the influence of chemical conditions on soils and surfaces. And, obviously, if the giving-off of hydrogen is a test of microbe activity, the process applied to soils may afford a test of the miasmatic condition of particular localities. Indeed, Dr. Smith himself observes that the new light which the process promises to throw upon cases where there is microbe action suggests the examination of so many substances, that 'the end of the inquiry seems far away.' Having stated his results, and their probable immediate practical utility, Dr. Smith presents speculations bearing on ideas which are just now very prominent in the minds of microbiologists. He tells us that he hoped to examine the known microbes of zymotic diseases in order to see if they also produce hydrogen; and he evidently expected to establish a relation in this way between such microbes and the microbes of upland waters. "It is probable," he continues, "that in sewage we have, at some stage or another, the germs of every disease existing in the community, and perhaps, if intensified enough, the germs of every possible disease;" and later on he states the problem still more definitely. Is any germ of disease, he inquires, dangerous or otherwise, according to the conditions to which it is exposed? Is the activity of the microbes found in water diminished by aeration? Are microbes in water of value, and, as they assist in the production of hydrogen when sugar is present, do they assist in digestion, or are they obstacles to digestion? Do the microbes constitute some of the secret qualities of waters which have been found good or evil in the opinion of so many of mankind? In other words, is absolutely pure water wholesome? A curious speculation in which he indulges is, that, given the hydrogen test as a measure of the chemical activity of microbes, we have the basis for calculating the electrolytic power of the movements involved in the life of a single microbe, and thus for arriving at the mechanical equivalent of a disease-germ. In the second part of his water report, Dr. Smith has described additional experiments on the elimination of nitrogen during putrefaction in water, offering further evidence of what he calls the natural purification of waters (first by putrefaction, and then by oxidation) in continuation of the interesting exposition in the report for 1882.

In a third part, Dr. Smith gives the results of a long series of experiments by means of Dr. Koch's gelatine process on samples of water obtained from the most varied sources. The method consists in mixing a purified solution of gelatine with the water experimented upon. In very impure waters the gelatine is first rendered fluid at the surface; and this fluidity gradually increases until the whole becomes fluid. The fluid swarms with bacteria. The results are registered by photographing the test-tubes. It is significant that the results by the gelatine process correspond very fairly with the indications by the hydrogen process, approximate gradations of activity in the same waters being shown by both methods. The value of these investigations will easily be seen.

BARK-LOUSE SECRETION.

THE past summer has been remarkable all through the northern states for the great numbers of large scale or bark lice. These lice have seriously injured our maples, white ashes, hickories, sassafrases, tulips, and elms. The eggs of these coccids hatch in May and June. The young lice attach their force-pumps beneath the leaves, where they sap the vigor of the trees the summer through. As the drying-up of the leaves in autumn gives a prophecy of a weakening stem, and prospective fall of the leaves, the lice desert the leaves, and attach their suction-pumps to the under side of the twigs and branches. I found that I could, by plucking the branches, hasten the migration of these lice from leaves to stem. The premature drying of the leaves caused the premature emigration of the lice. In early spring the scales — for now the lice are plump, scale-like creatures — grow very fast; and so rapid is the nectar secretion which exudes from the lice, that the leaves twinkle and fairly drip with this bark-louse nectar. The grass and walks beneath the trees become sticky with the unctious sweet.

The species of coccid which infests the maples secretes a cotton-like, fibrous mass, in which the eggs to the number of seven hundred or eight hundred are placed. This cotton-like nidus pushes out from behind, and raises the scale from the branch. In other species the hundreds of white eggs are concealed beneath the brown scales.

The nectar from these bark-lice is dark in color, of rank odor, and bitter and unpleasantly pungent to the taste. Though the bees appropriate this secretion, they refuse it entirely when they can gather from flowers. In actions they say, 'Better this than none, but never this when other is possible.' The bees regard this questionable sweet just as they do grape-sugar, — only to be accepted in lieu of naught else. The odor of this nectar is so rank, that its presence on trees is often quickly detected when one passes by. In many sections the past season the bees gathered this liquid by tons. I know of cases where the odor in the apiary was so strong that the bee-keepers thought they were victims to that terrible fungoid malady, 'foul brood,' which bee-disease is indicated by a nauseating stench.

This bark-louse nectar presents a strong contrast

to that of Aphides. It is dark, not light, in color; disagreeable, not pleasant, to the taste; distasteful to the bees, and not coveted by them; unwholesome for winter food for bees, and positively injurious to honey which is to be placed on the market.

Yet this bark-louse cloud has its silver lining. In early spring, before the flowers bloom, it stimulates the bees to their highest endeavor in breeding, so that well-stocked colonies greet the clover-bloom. The apiarist has only to extract this dark, ill-flavored honey at the dawn of the clover season, to convert a seeming ill into an unmixed blessing; especially as this coccid nectar is equally as good as honey for various manufacturing purposes, as the making of printers' rolls, the flavoring of cigars, and the manufacture of honey-cakes. Knowledge and caution on the part of the bee-keeper will keep this dark honey wholly separate from the other, and thus eliminate all harm, and make the former of no small advantage to him.

A. J. Cook.

ECONOMY OF FUEL.

How much can be accomplished in the way of economizing in fuel is shown by the results obtained lately on a trip of the Burgos, a freight-steamer built to carry cargo cheaply at a slow speed. Her engines are on the triple compound system, where the steam — in this case from a boiler-pressure of a hundred and sixty pounds per square inch — is expanded in three cylinders in succession. The average speed at sea, in all weathers, is very nearly ten miles per hour. In a voyage from Plymouth, Eng-, to Alexandria, on the way to China, with a cargo weighing 5,600,000 pounds, and in a distance of 3,380 miles, the consumption of coal was 126 tons (or 282,240 pounds), being at the rate of 83.5 pounds per mile, or .03 of a pound per ton of cargo per mile: in other words, half an ounce of coal propelled one ton of cargo one mile. The *Railroad gazette* very neatly says, "Assuming that paper is as efficient a fuel as coal, we have only to burn a letter on board this steamer to generate and utilize enou gh energy to transport one ton of freight one mile. It is difficult to realize that so trifling an act as burning a letter involves such a waste of useful energy, or can have any reference to the energy sufficient to perform a feat which, under less favorable circumstances, requires a couple of horses and a teamster for about half an hour."

We may contrast with her performance that of the steamship Oregon, of the Guion line, where every thing is sacrificed to speed. The Oregon has engines of 13,000-horse power, 12 boilers, 72 furnaces, a cargo capacity some seven or eight times that of the Burgos, but intended for passenger business largely, attains an average speed of 17.9 knots (or 20.5 miles) per hour, and burns 337 tons of coal per hour, combustion taking place at the rate of over 16 tons of coal for each mile traversed. The cost of her coal for the voyage is put at considerably over $18,000.

The best locomotive performance in this country of which there is authentic record gives a consumption of about two ounces of coal per ton of freight hauled one mile, at the rate of thirteen miles per hour including stoppages, and rising to five or more ounces per ton per mile on grades of from fifty to seventy feet.

EXPLOSIVES AND ARMOR-PLATE.

During the last session of congress the theory was advanced that the effect of a moderate weight of dynamite, exploded in contact with the plates of a modern armor-clad ship, would be disastrous to the vessel. The Naval bureau of ordnance has tested this by exploding charges of gun-cotton and dynamite varying in weight from five to one hundred pounds, against a vertical target composed of nine layers of one-inch wrought-iron plates, strongly backed with twenty inches of wood, and braced so as to represent, as well as possible, the stiffness of the sides of a ship. Though much more work was done than it is likely would ever be performed against the armored side of a ship, the target was not materially injured.

In the course of these experiments it was apparently shown that the point at which a charge of a high explosive is ignited has an important effect upon the work done, since the effects of these charges were readily increased or diminished very materially, according as they were ignited on the side away from or adjacent to the plate; and this, too, notwithstanding the distance between the points of ignition in the two cases was only a foot. It is claimed that this result shows that the charge of a high explosive cannot furnish any tamping effect, but that to produce the greatest effect the ignition must be at some interior point of the explosive, well toward the rear. It also appears that the effects do not increase proportionally to the increase of the charge when the ignition surface remains constant.

The gradual ignition of the charge, even in the case of so violent an explosive as gun-cotton, was strikingly illustrated by the fact that when twenty-six pounds of wet compressed disks of that material were piled upon an iron plate, and exploded from the top (without tamping or cover), accurate impressions of the lower disks in the pile were stamped upon the iron underneath them. In this case there did not seem to be the least doubt concerning the complete explosion of the charge.

Experiments were also successfully made in firing shells charged with gun-cotton from ordinary rifled cannon, twelve rounds being fired from the twelve-pound howitzer, and thirteen rounds from the eighty-pound breech-loading rifle, and the ordinary service charges of gunpowder being used in the gun. Three unfuzed shells, charged with gun-cotton, were fired from the eighty-pounder against the target used in the dynamite experiments. The shells exploded with great violence, on impact; but the damage to the target was very slight, as the explosion took place before any practical penetration was effected. In view of recent successful experiments with a fuze

designed to explode wet gun-cotton, the bureau has under consideration a plan of a piece which is intended to project an aerial torpedo, charged with a hundred pounds of wet gun-cotton, to be exploded over or upon an enemy's deck.

RECENT RUSSIAN GEOGRAPHICAL EXPLORATIONS.

AT the meeting of the physical section of the Imperial Russian geographical society, held Dec. 9, mention was made of Melnikow's archeological researches in the district of Troitzk and in the province of Mohilew. A few tumuli and prehistoric buildings had been examined, among which Melnikow claimed to have discovered cromlechs. Professor Sorokin travelled in central Thian Shan from Wernoje to the Issyk-Kul, thence by the Ula-Khom Pass to the Naryn valley, and by Mart Pass to Na-Manghan in Ferghana. Old buildings were found on the shore of the Issyk-Kul, but no traces of any under the water. Limestones of very new formation were discovered in the lake. Professor Muschketow gave a *résumé* of Konshin's travels in the steppe east of the Caspian, including a part of the old beds of the Amu-Daria, which was followed by an interesting discussion in regard to these beds.

At a later meeting of the society, Dec. 17, Mr. Lessar read a communication on the country and tribes on the Afghan frontier. He first recalled his remarks made last year, that the only means of thoroughly subduing the Turcoman steppe was to annex Merv, and that it was comparatively easy at that time on account of the prestige of Russia. His expectations had been more than realized, as not only Merv had been peacefully annexed, but the country of the Saryks, southern Turcomania, had submitted. The peaceful annexation of Merv was said to be partly due to the conviction of the people that they would never have peace while there was not a power strong enough to enforce it, and that Russia was this power. After the subjection of Merv, the Russians came in contact with the Saryks, who had been hitherto very little known. Lessar found a great difference between the natives of Jalatan, near Merv, and of Pende, which is farther south. The former are very poor, not even possessing the commodities most prized by nomads, viz., good felt-tents, fast horses, etc.; while this kind of wealth is more abundant in Pende. The people are not entirely nomadic, but know something of agriculture. They make use of artificial irrigation, though their method of storing and conducting water is very crude, and they know nothing of levelling. Lessar made the interesting discovery that the mountains in the south are very low, and composed of soft strata; while the same chain is much higher and steeper to the west and east. The Salors, a small tribe living near Merv, are very poor, the probable reason being the long cessation from robbing expeditions, while agriculture and stock-raising are rendered insecure by the incursions of their neighbors. A. WOEIKOF.

EMMERICH ON THE CHOLERA BACILLUS.

THE *Lancet* of Dec. 27, 1884, gives a very interesting *résumé* of a paper by Dr. Rudolf Emmerich, which is to be published in the forthcoming number of the *Archiv für hygiene*. The remarks are taken from advance proofs, and the original article has not yet reached us. The observations were made during the epidemic in Naples, and at the instance of the Bavarian government.

Dr. Emmerich did not limit himself to observations upon the comma bacillus, but attempted to discover other organisms by means of various culture-media and methods. He procured blood upon a sterilized platinum needle from the median vein of a young woman in collapse from cholera, and about six hours before death. He inoculated ten tubes containing nutrient gelatine in three places each, and found organisms in three of them, the other seven remaining sterile.

The organisms were all of one kind, cylindrical, with rounded ends, and occurring singly or in pairs, the length being about one and one-half times more than their width. They grow at ordinary temperatures in slightly alkaline nutrient gelatine, which they liquefy in solid opalescent patches. Under a low power ($\frac{1}{90}$), the colonies in the deeper portions of the gelatine present the form of a hone: those more superficial are like flat, circular mussel-shells.

The deeper colonies are yellowish brown by transmitted light, white by reflected light, and are finely granular. Those on the surface are pale yellow in the centre, whitish at the margin, and spread over the gelatine in a film.

These organisms were cultivated from the blood and from the internal organs of nine persons dead of cholera. They were most numerous in the kidneys and liver, then in the lungs, and least abundant in the spleen. They were found in sections of the intestines and kidneys (other organs not yet examined), and in very large numbers in the dejections and intestines after death. They grew in every culture experiment with alvine cholera material, whereas the comma baccilli only occurred in some cases.

Inoculation experiments were made at the Hygienic institute of Munich in conjunction with Dr. Sehlan. The animals used were mostly guinea-pigs, and symptoms were produced similar to those of cholera. The changes noticed varied from a simple desquamative catarrh, with rice-water-like intestinal contents, to hemorrhagic exudation, and destruction of the mucous coat.

The inoculations were made by the injection of two drops of a solution of a portion of a pure culture the size of a pin's head in two drams of water into the lungs, or subcutaneously. This produced an illness of from five to six days, with marked changes in the intestinal mucous membrane. The injection of a large quantity produced death in from sixteen to thirty hours, but with much less marked changes in the intestines.

The publication of the full paper is awaited with

very great interest. At present, and before we know the exact conditions under which the experiments were performed, it is impossible to form a correct judgment as to their value. The number of repetitions, and, in fact, all the details of the work, are needed in order to a just estimate of its correctness.

THE SCIENTIFIC PRINCIPLES OF AGRICULTURE.

Under the will of its founder, the Sherardian professor of botany in Oxford university was to hold also the Sibthorpian professorship of rural economy. The duties of both, but of the latter more particularly, were performed by Dr. Daubeny while he held this honorable post. His immediate successor, we suppose, gave his attention to the botanical chair; and the present incumbent, holding the ancient Sherardian professorship only, will doubtless give a fresh impulse to botanical study in the university. Under a chancery decree, the Sibthorpian professorship of rural economy is now independently established, and its duties defined "to lecture on the scientific principles of agriculture;" the amount of service is raised from 'one public lecture in each term' to twelve lectures annually; and Dr. Gilbert, for forty years the associate of Mr. Lawes at Rothamsted, and still so associated, was called to fill the chair. The continuous and well-concerted work done by these two men during the last forty or fifty years is now fairly well known and appreciated in all scientific circles; thanks, especially, to the extensive publication of a great part of the results in the Transactions of the Royal society. Mr. Lawes began his systematic investigations, we believe, while he was an undergraduate, more than half a century ago, by experimenting with manuring substances upon plants in pots; and when in 1834, on attaining his majority, he came into hereditary possession of the manor of Rothamsted, he at once set on foot the systematic experiments which are still in progress. It is understood that he has made ample provision for their continuance in the future. Although it could add nothing to his scientific fame, it was in fitting recognition of his services to his country that this inheritor of a handsome landed estate and a noble old manor-house was recently made a baronet. Equally fitting it is that Dr. Gilbert should now be called upon to present, in comparatively untechnical form, the general results and applications of his accumulated knowledge, and to inform the minds of those who will in great part become landlords, or country clergymen, or statesmen, to whom such instruction will form a proper and a very important part of a liberal education.

Dr. Gilbert's numerous scientific associates and personal friends in the United States, and not least those who had the pleasure of meeting him during his two visits to this country, while they read with interest the inaugural lecture delivered last spring, are hoping to have before them, in due time, the remainder of the course so happily begun, also its prospective continuation, to take the place in our day which was filled forty years ago by Johnston's lectures on agricultural chemistry and geology. 'A good deal has happened since then,' of which Dr. Gilbert can give excellent account. As an introduction to such an account, and to a popular exposition of the results attained during this interval, — much of it at Rothamsted, — nothing can well be more fit than this inaugural lecture. Agriculture is well said to be 'the concentrated production of food;' and the scientific principles upon which improvements in the art of concentrated production depend are drawn from the chemistry of the soil and atmosphere, and the chemistry along with the physiology of vegetation and of animal life. Of course, the subject will be treated by the present Sibthorpian professor from the chemical side. In this lecture the history of the subject is sketched from Saussure's analysis of plant-ashes in 1804, and Priestley's discovery of oxygen and of its liberation by growing plants, down to the researches of Liebig and Dumas, and ending with a sketch of the systematic field and laboratory work which has been carried on now for forty years by Sir John Lawes and himself. For the details of these prolonged experiments, and the full discussion of the results, see the elaborate memoirs published last year in the Transactions of the Royal society of London.

Introduction to the study of the scientific principles of agriculture: being the inaugural lecture delivered May 6, 1884, at the University museum, Oxford. By Joseph Henry Gilbert, Ph.D., LL.D., Sibthorpian professor of rural economy, etc. 47 p. 8°.

CHADBOURNE ON INSTINCT.

Prof. P. A. Chadbourne's Lowell lectures on instinct have reached a second edition; but the author has neither seen reason to alter the statements of the first edition, nor found time

Instinct: its office in the animal kingdom, and its relation to the higher powers in man. By P. A. Chadbourne. [Second edition.] New York, *Putnam's sons*, 1883. 323 p. 12°.

to incorporate in this one the new material that, as he tells us, he has prepared for a continuation of his discussion. This new material is to appear soon in another form; and, until it appears, we must postpone any detailed criticism in these columns of our author's known views. That the book contains much fair discussion of theories, and a very readable collection of facts, is plain enough; and, on the other hand, one need not dwell on the consideration, that, in their present form, these lectures cannot be considered as abreast with the advance of so rapidly growing a study as this. We shall add here only one criticism; namely, that there is, in this work, one obvious imperfection that has especially to do with our author's principal purpose itself. Professor Chadbourne studies instinct in animals that he may throw more light on the place and relations of instinct in man. But, just when he comes to speak of human nature, his psychological foundation is so antiquated, that all his learning helps us, his readers, but a little way. It is the old schematized and abstract psychology that is in his mind throughout, with its 'rational' and 'moral natures' of man, with its more or less complex scheme of subdivisions in each of these 'natures,' and with its notion of an abstractly defined hierarchy of human powers. For very elementary instruction, not in psychology as such, but in morals, this old psychology will still do well enough, no doubt, as a sort of rough working hypothesis; but the scheme is unreal, and modern psychology finds little use for it.

For this reason it is, that, when our author draws an elaborate parallel between the functions of the sense of obligation and those of the instincts, we feel that the undoubted actual likeness of these two sets of phenomena is distorted in his description, for the sake of fitting the facts to an *a priori* notion about the 'higher spiritual nature' of man. When he gives us an elaborate diagram, representing the place of the instincts among human faculties, we feel that this diagram represents a sort of stuffed soul, badly mounted, as it were, and no living soul of man at all. When, again, an argument for immortality peeps out from behind our author's classification of the belief in immortality as an instinctive human belief; when, in fact, we are told that one instinct ought to be as well founded as another, and that the belief in immortality is as much an instinct as is the instinct of an insect to lay eggs in autumn, — we feel only a sense of vexation that an ill-conducted analysis of human nature, accepted by our author from tradition, should be used by him for such a purpose in a scientific course of lectures. Why mix together utterly separate lines of consideration? Our belief in the real goodness of things, and in the worth of life, gains no whit, and can only lose force, by being confused with investigations into external physical phenomena, or even into the laws of the sequence of mental states. That tradition has long since sanctioned this confusion is no justification for it here.

RECENT TECHNICAL BOOKS.

CAIN'S algebra contains two entirely distinct essays. In the first of them, with the hope of making the treatment of negative quantities clear to the student of elementary mathematics, the author represents real quantities in the usual way, — by lengths laid off upon a straight line, towards the right from a fixed origin on the line if the quantities are positive, towards the left if they are negative, — and develops successively the rules for algebraic addition, subtraction, multiplication, and division, by the help of this concrete conception. The rules thus obtained are then shown to be generally applicable to all problems, whether the difference between positive and negative quantities in them is one of opposition in direction or not; and the essay closes with some remarks on the generality of formulas of trigonometry and analytic geometry proved for a single case.

In the second essay, Professor Cain describes some methods common to all sciences of reasoning, compares and illustrates by examples the analytical and synthetical methods for the solution of problems, and finally discusses a few examples in finding the equation of loci, where some solutions are lost in the course of the work, or where some strange ones are introduced. The distance of the point P' from the point P seems to be written indifferently PP' or $P'P$. The little book would doubtless prove interesting and suggestive to any student

Symbolic algebra, or the algebra of algebraic numbers, together with critical notes on the methods of reasoning employed in geometry. By Prof. W. CAIN, C.E. New York, *Van Nostrand*, 1884. (Van Nostrand's sc. ser., No. 73.) 131 p. 18°.

Testing-machines: their history, construction, and use. By ARTHUR V. ABBOTT. New York, *Van Nostrand*, 1884. (Van Nostrand's sc. ser., No. 74.) 190 p. 24°.

Stadia surveying: the theory of stadia measurements, accompanied by tables for the reduction of stadia field-observations. By ARTHUR WINSLOW. New York, *Van Nostrand*, 1884. (Van Nostrand's sc. ser., No. 77.) 148 p. 24°.

The steam-engine indicator, etc. By W. B. LE VAN. New York, *Van Nostrand*, 1884. (Van Nostrand's sc. ser., No. 78.) 169 p. 24°.

of mathematics who would spend a couple of hours in perusing it.

The historical part of Abbott's 'Testing-machines' is very brief, and consists of little more than a catalogue of machines built and used in the United States before the war. The second part of the volume treats of the construction of testing-machines, and the appliances used with them. The author describes very fully and clearly the apparatus made by the Fairbanks company, and much more briefly the machines of Emery, Riehle Brothers, Gill, and Olsen. The remainder of the book relates to the use of the testing-machine, and will be found a convenient handbook of instruction for beginners. It points out certain precautions which must be taken before and during a test; speaks of the appearance of the fracture as an indication of quality; shows what effect is produced upon results by varying the size of the specimen, the time of making the test, or the temperature of the piece under examination; and gives several valuable tables.

The author has apparently been very fortunate in obtaining definite indications of the 'elastic limit' by a method which he describes on pp. 84 and 138. As shown on his diagrams facing p. 82, this limit is indicated by a sharp change in the direction of the 'stress strain' line, amounting to nearly 90°, shortly followed by a sudden return of the line to its original direction.

These two points of inflection, occurring so uniformly in an otherwise regular curve, would seem to point quite strongly to some peculiarity of his apparatus. Indeed, we should expect something of the sort in the use of a testing-machine driven at a constant speed, as soon as the test-piece begins to stretch faster than the rate of the machine. The apparent elastic limit obtained in this way would not depend wholly upon the material tested, but could be made to vary by changing the speed of testing.

Most of Winslow's little treatise on stadia surveying is occupied by tables, — first, of horizontal distances and differences of level, to be used in the reduction of stadia field-observations; and, second, of logarithms (to four places of decimals) of sines and tangents, — but is preceded by forty-two pages devoted to an exposition of the theory of stadia measurements. This brief explanatory part would have been more satisfactory if it had been revised after its appearance in *Van Nostrand's engineering magazine*, so as to obviate the criticism which appeared in the number of the same magazine for June of last year.

In that paper it is shown, by Mr. R. S. Woodward of the naval observatory, that the formula expressing the relation between conjugate distances and the principal focal length of a lens, or system of lenses, is exact if properly interpreted, and applies equally well to any combination of lenses; and that the ordinary formula for the stadia instrument, if properly understood, is exact, whatever may be the number, kind, or disposition of the telescope lenses, so long as they are properly centred. This criticism, however, does not affect Mr. Winslow's statement of the general principles of stadia practice, but really confirms our belief in the superiority of stadia measurement to ordinary chaining. The eight pages of tables, previously used on the geological survey of Pennsylvania for reduction of observations, we think will be found serviceable to engineers engaged in stadia work.

Le Van's little book was prepared originally as a series of articles for the *Mechanical engineer* of New-York City. It has now been revised, extended, and re-written to some extent, for publication in its present form. It is an elementary treatise upon the indicator, and evidently intended solely for the class of readers to which it was addressed at its first appearance, — to those "whose education," as its author says, "has been and must be rather in the engine-room than in the class-room." Its publication in the periodical for which it was prepared is not a matter for public criticism; nor, perhaps, would be its presentation in this later form, except for the fact that the excellent work of Porter, its reproduction with doubtful propriety by an American editor and publisher, and the issue of the work of Mr. Pray (another 'expert' of unquestionable practical experience and skill), have hardly left a place for it. It lacks the precision of the first, and the thoroughly practical character of the other.

We find no satisfactory description of the familiar forms of instrument in the book. The introductory part contains a misleading calculation of the gain in fuel by expansion, showing an increase of economy which is never reached in the best of engines, and never even approximated in ordinary forms of the motor. The explanation of the indicator diagram, and the method of working it up, will be useful, and will be most carefully studied by the readers for whom the book is prepared. The fact that its author is thoroughly familiar, by practical use, with the instrument which he describes, is evident throughout; and this will probably aid in securing for it a sale.

ELECTRIC LIGHTING IN THE UNITED STATES.[1]

DR. ERNST HAGEN, professor of applied physics in the Royal polytechnic school of Dresden, visited the United States in 1884, and, having carefully examined the different systems of electric lighting there in vogue, presented a report to the directors of public buildings of Berlin. The largest portion of this report is devoted to the subject of incandescent lighting. A certain space is given to accumulators, and arc-lighting is also considered. The writer states in his preface that his travels have deepened in him the conviction that the subdivision of the electric light by means of the Hefner-Alterneck differential lamp gives a greater degree of steadiness than is possible with the lamp of any of the American systems.

The author enters at first into a comparison of the cost of electric lighting in general with that of gas and other sources of light. He shows that nearly ninety per cent of the energy produced by the ordinary gas-flame is in the form of heat, leaving only about ten per cent in the form of the radiations which appeal to us as light. He also discusses the subject of the noxious gases given off by illuminating-gas, and the poisonous compound called by DuBois-Reymond 'anthropotoxin,' which accompanies the carbonic-acid gas, and finds much to condemn in the use of illuminating-gas, and much good to expect in the further extension of the incandescent system of electric lighting. When amount of light and health are considered, the incandescent system is economical: viewed from the point of dollars and cents, however, this cannot be proved.

The author gives a short history of the development of the dynamo-machine, and the reader will find here a better summary than in any similar work with which we are acquainted. The use of diagrams and modest engravings, instead of the full-page illustrations of many recent treatises, is especially refreshing and comforting to one's pocket. The head is filled, while the pocket is not depleted, which cannot be said if one buys most treatises on electric lighting.

We learn from the chapter on the incandescent light, that Swan and Edison came almost simultaneously to the invention of the carbon-filament lamp, which, indeed, had been used in an imperfect way by inventors long before them. Both Swan and Edison reached the result of a more or less permanent incandescent lamp in 1879. The writer closes his history of the incandescent lamp by a glowing eulogy of the man who had the genius to create a new industry which employs hundreds of workmen, and to conceive of the grand project of lighting by electricity a great city from a central station. That this could have been accomplished without the careful training of the German polytechnic schools, evidently impresses the author.

Dr. Hagen corrects the impression, which is evidently carried abroad in certain quarters, that the whole of New York is lighted by the Edison system. He computes that New York proper covers eleven square miles, and the portion lighted by Edison embraces only a tenth of a square mile, and covers an area comprised within a circle of a little less than a thousand feet radius. A map of the region covered by this system in New York is given; and the dimensions and construction of the main leading wires, and the method of insulating them in underground pipes, are fully described, with a running criticism of the results that have been attained.

It is the author's opinion that large central electric-lighting stations will be established in all great cities, if the experiment in New York does not show some at present unforeseen obstacles. The system of underground wires forms, in his opinion, one of the greatest obstacles. There is no doubt that the insulation grows worse with time, and it is a question how much of the electrical energy is lost by defective insulation. He very properly remarks that the entire resistance of the circuit, including of course the lamps, must be considered, together with the loss of insulation in the underground conductors, and that even a very large loss of insulation might not consume more electrical energy than a single lamp.

The Edison plant is then carefully described, and the dimensions of the various machines fully given, together with the means of regulating the current, the method of weighing it and distributing it. We do not know where to look for a more careful description of the construction of the underground cables and the method of insulation. The author concludes, that, for equal amount of light, the Edison light costs about a third more than gas. In spite of this increased expense, the number of subscribers has continued to increase since the opening of the system, Sept. 3, 1883, and great satisfaction has been expressed with the light. Whether the system is suitable for

[1] *Die elektrische beleuchtung.* Mit besonderer berücksichtigung der in den Vereinigten Staaten Nord-Amerikas zu centralanlagen vorwiegend verwendeten systeme. Von Dr. ERNST HAGEN. Berlin, *Springer*, 1884. 8+307 p., illustr. 8°.

maintaining sixteen thousand lamps, even if only a fifth part would be in use at one time, and also for supplying power to small motors, is still in doubt. At present power is not supplied. It was intended that the system should be used for supplying power in the day-time, and light at night.

Leaving the central station in New York, Dr. Hagen then proceeds to inspect the village plant at Roselle, N.J., and studies this new and promising development of electric lighting, of which there are already several examples in the United States, notably that at Brockton, Mass. At Roselle three so-called two-hundred-and-fifty-light machines are installed, which are driven by a thirty-five-horse power engine. The price is a dollar per thousand candle hours (*kerzenstunde*). The electromotive force of the machine is 320 volts, and the current per lamp $\frac{48}{100}$ of an ampère. The number of lights in practical use is 800. The greatest distance to which the system is carried at present at Roselle is about 4,500 feet.

The writer then discusses the system of the U. S. electric-lighting company, which uses the Weston machine and the various modifications of the Maxim lamp, also the Bernstein electric-lighting system. The author closes his interesting and valuable discussion of the various systems of incandescent lighting by a *résumé* of the measurements made at Munich and at Paris, and an analysis of the cost of the Edison system. In this chapter will be found statements of the cost of this system from various agents of mills which are lighted by the incandescent light. So many elements peculiar to each installation enter into this analysis, that it is impossible to say in general what the cost of electric lighting is. Each business-man must decide for himself whether it is economical, on the whole, for him to use the electric light or not. In many cases there is decided advantage, and even economy, in its employment.

Dr. Hagen details in a graphic way the hopes raised by the various storage-batteries, and the leaden thoughts of those who have had their hopes dispelled. These batteries at present are useful only in laboratories.

The third portion of Dr. Hagen's treatise is devoted to arc-lighting, and in it the systems of Brush, of Weston, and of Thomson-Houston, are fully described. The treatise closes with a short essay on the dangers of electric lighting, and a copy of the regulations adopted by the board of fire-insurance inspectors in Boston.

NOTES AND NEWS.

Mr. Henry Lomb of Rochester, N.Y., has offered, through the American public health association, the sum of $2,800, to be awarded as first and second prizes for papers on the following subjects:—

1°. Healthy homes and foods for the working-classes: first prize, $500; second prize, $200. Essays to be of a practical character, devoid, as far as possible, of scientific terms. They must be within the scope and understanding of all classes, and designed especially for a popular work. 2°. The sanitary conditions and necessities of schoolhouses and school-life: first prize, $500; second prize, $200. 3°. Disinfection and individual prophylaxis against infectious diseases: first prize, $500; second prize, $200. 4°. The preventable causes of disease, injury, and death, in American manufactories and workshops, and the best means and appliances for preventing and avoiding them: first prize, $500; second prize, $200.

All essays written for the above prizes must be in the hands of the secretary, Dr. Irving A. Watson, Concord, N.H., on or before Oct. 15, 1885. It is expected that arrangements can be made to have these essays widely distributed to the public, and to the persons most interested in the respective subjects in the United States. The American public health association earnestly appeals to those able to compete, to take part in this work, which, it is believed, will do much to augment the health, comfort, and happiness of the people.

— In addition to the issue of its regular publications, the Leander McCormick observatory of the University of Virginia (Professor Ormond Stone, director) has begun the issue of a series of circulars, of which the number just received contains the elements and ephemeris of the small planet Barbara No. 234. The elements and perturbations by Jupiter were computed by Mr. S. M. Barton; and the perturbations by Saturn and the ephemeris, by Mr. F. P. Leavenworth.

— The quinquennial prize offered by the Belgian government for researches in mathematical and physical science has been awarded to Professor Le Paige of the University of Liége, for his investigations in the higher geometry, and especially for those relating to lines and surfaces of the third order.

— The valuable Cohen collection of Egyptian antiquities, which has recently been acquired by the Johns Hopkins university, will be of great interest, not only for art, but for the historical study of the customs and laws of Egypt. It was begun in 1832 by Col. M. I. Cohen, during his travels in Egypt, and consists of six hundred and eighty-nine objects, procured mainly in the localities where they were originally discovered. A number of objects, however, belonged to the famous collection of Mr. Salt, her Majesty's consul in Egypt, which was sold in 1835. The collection consists chiefly of small works illustrating the history of the minor arts in Egypt

from the xviii. dynasty to that of the Ptolemies. The university has also purchased casts, on a reduced scale of 1:10, of the two pediments of the temple of Zeus at Olympia. They had recently been executed at Berlin, under the direction of Curtius and Hirschfeld, by the sculptor Grüttner.

— E. and F. N. Spon announce as in preparation, 'Electricity in the house,' by E. Hospitalier, translated by C. J. Wharton; also "The animal food-resources of different nations, with mention of some of the special dainties of various people derived from the animal kingdom," by P. L. Simmonds.

— Specific characters of considerable importance are found in the position of the resin-ducts and development of the hypoderm cells in the leaves of Abietineae, especially in the perplexing genus Abies. The value of these characters is recognized by special students of Coniferae; and material for the more general study of the structure of the leaves of all the North-American species, exclusive of those of Mexico, is now available for botanists. Mr. J. D. King of Cottage City, Mass., director of the department of microscopy in the Martha's Vineyard summer institute, has prepared and offers for sale microscopic sections of the sixty species of Abietineae of the United States. The sections are cut as thin as practicable, varying from a hundredth to an eight-hundredth of an inch, and are so prepared by bleaching and double staining as to show the cross-section and the whole structure of the leaf very perfectly. These specimens are prepared from material collected in connection with the census investigation of the forest wealth of the United States, and were supplied for the herbarium of the Arnold arboretum by Professor Sargent.

— The crisis in the grain trade, and the American and Indian competition in this commodity, are the topics of the day in Russia, and are being discussed in no less than three societies in St. Petersburg, each of them devoting more than one session to these topics.

— The need of a periodical of high character, devoted to the advance of archeological studies, and to the promotion of interest in them in America, is widely felt; and, to supply this need, it is proposed to publish quarterly, under the title of *The American journal of archaeology*, a journal devoted to the study of the whole field of archeology, — oriental, classical, early Christian, mediaeval, and American. The Archaeological institute of America has recognized the journal as its official organ. The following is a list of the editorial staff, so far as at present formed: advisory editor, Professor Charles Eliot Norton of Harvard college; managing editor, Dr. A. L. Frothingham of Johns Hopkins university, to whom all communications should be addressed; special editors, Dr. A. Emerson of Johns Hopkins university, Mr. T. W. Ludlow of New York, Professor Allan Marquand of Princeton college, Mr. A. R. Marsh of Harvard college, and Mr. Charles C. Perkins of Boston. A reserve fund is required in order to meet the deficit which must occur during the first few years of the journal's existence. Contributions to it are solicited, and may be forwarded to the Safe deposit company of Baltimore, which acts as trustee of the fund. Notification of such remittances should be made to the managing editor.

— Professor Spörer, at a recent meeting of the Berlin meteorological society, gave a brief sketch of the present period of sun-spots. The spot-periods being counted from minimum to minimum, the commencement of the present spot-period was to be referred to 1878. So far as had hitherto been observed, the present was distinguished from the last two spot-periods by two peculiarities, — first, that the maximum in the present period appeared to have occurred four-tenths of a year later than in the previous periods; and, second, that during the maximum, the distribution of the solar eruptions showed an essentially different character from that usually obtaining. In the former periods it was observed during the maximum that the greatest concourse of spots surrounded with faculae occurred in the median latitudes of the sun; that they were completely wanting towards the poles, became less numerous also towards the equator, and only at the equator itself did they again become somewhat more crowded. In the rotation of the sun, those eruptions showed a heliographic displacement towards the equator, in contrast to the spots free from faculae, which, in the course of rotation, wandered towards the poles. During the minima of the spot-periods the maximum of the eruptions was generally found in the neighborhood of the equator. In the present period, again, the greatest concourse of eruptions surrounded with faculae was found towards the equator during the maximum as well, — a phenomenon usually occurring at the time of the minimum. The present, on the other hand, resembled former periods in the circumstance that it was only on rare occasions that the concourse of spots was alike on both hemispheres of the sun. In the majority of cases, either the northern hemisphere presented a more copious display of spots than the southern, or the southern mustered them in larger numbers than the northern.

— The inhabitants of the small town of Geinhausen, in Hesse, are putting up a bronze memorial bust of their distinguished townsman, Philipp Reis, as the inventor of the musical telephone.

— The Italian explorer, Capt. Cecchi, has sailed for the west coast of Africa in the Garibaldi.

— The lack of amusements at San Diego, Cal., is causing some talk of establishing a botanic and zoölogical garden. The great natural advantages, especially of climate, would make such an institution, in competent hands, of great practical utility and scientific value, and far less expensive to sustain than in the Atlantic states.

— Mr. Tresca reports to the French academy in the *Comptes rendus*, Oct. 6, that a system of electric lighting, including both arc and incandescent lamps, was arranged from the electrical exposition building in Turin over a distance reaching to 40 kilometres (24.2 miles). The committee of the exposition, in-

cluding Gaulard, Gibbs, and Tresca, established a circuit between the station of Lango and intermediate stations, — a circuit of which the total length was 80 kilometres (about 50 miles). The wire was of uncovered chrome bronze 3.7 millimetres in diameter. The current was produced by a Siemens alternating machine of the thirty-horse power type. New forms of secondary generators devised by Gaulard and Gibbs enabled the following different types of electric lighting to be maintained: 1°. At the exposition building, 9 Bernstein lamps, 1 Soleil lamp, 1 Siemens lamp, 9 Swan lamps, and 5 other Bernstein lamps placed at a short distance (these lamps required different potentials); 2°. At the station of Turin Lango, distant 10 kilometres, 34 Edison lamps of 16-candle power each, 48 of 8-candle power, and 1 Siemens arc-lamp. On the 29th of last September the system included the station of Lango, distant 40 kilometres, where 24 Swan lamps, requiring 100 volts, were maintained with perfect regularity.

— At Memphis, Tenn., on the Mississippi River, a caving bank rises straight up from the water's edge at its base to a height of from ten to fifty feet. To check the steady disintegration and undermining from the action of the current, the U. S. engineers are employing a method of protection which has been successfully tried at other points on this river. A blanket or willow and pole mattress is placed along the slope of the bank from high-water mark to the bed of the river. These mattresses are some fifty feet wide and from two hundred to a thousand feet long, of flexible willows bound together by poles and wire. They are made on boats having a length equal to the width of the mattress, and are built on an inclined platform, from which they slide down into the water as fast as woven. They are weighted and sunk by stones, and further secured by stakes. The sunken mattresses prevent undermining below the low-water line; and the grading-down of the overhanging bank, by jets of water thrown by powerful steam-pumps, stops all undermining above that line. The space between the upper edge of the mattresses and the top of the bank is protected with willows and stone.

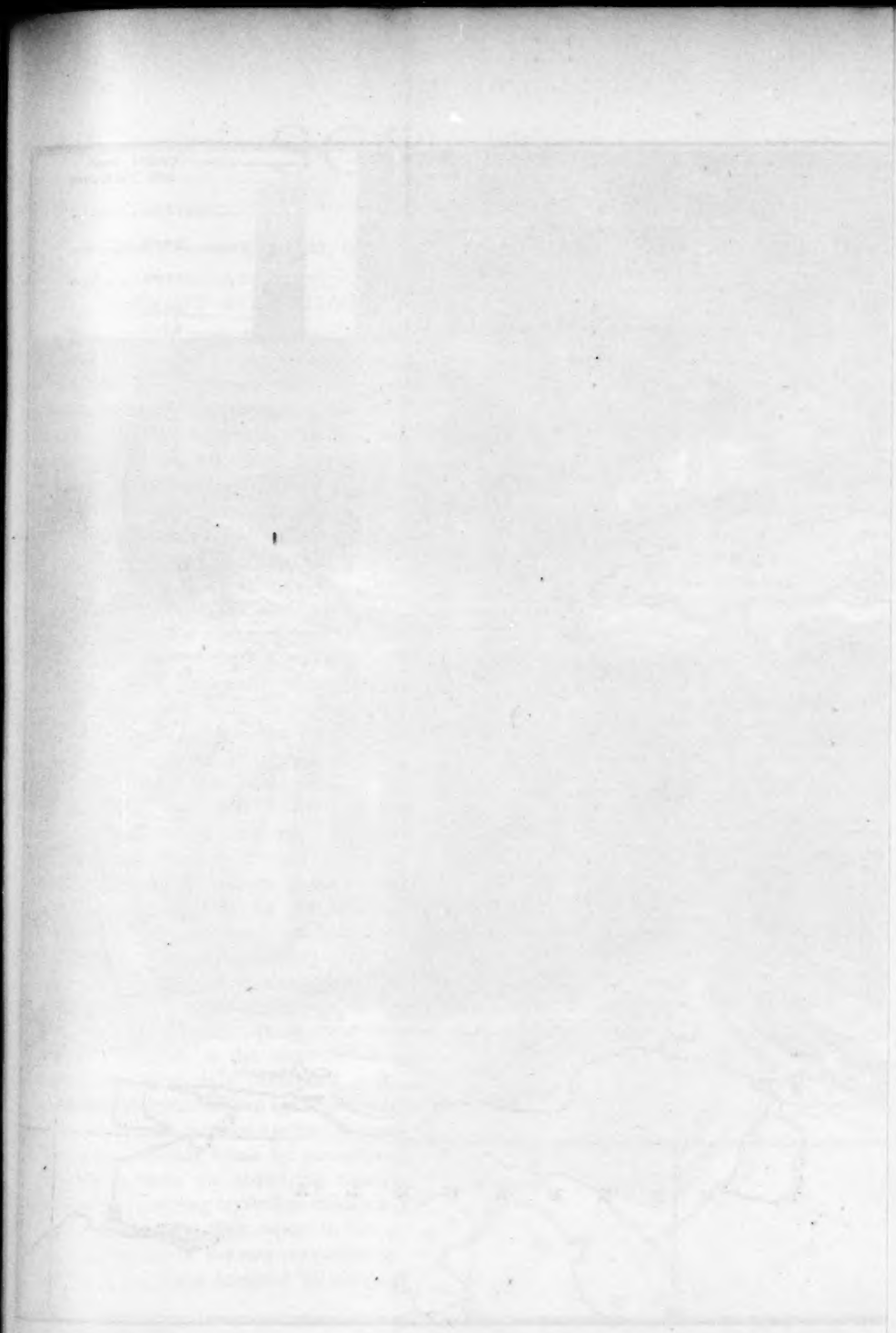
— In some recent investigations on the growth of leaves, published in the *Journal of the society of arts*, Messrs. Zoller and Rissmüller have shown, that while in early summer the leaves of plants contain very considerable amounts of nitrogen, phosphoric acid, and potash, these substances are withdrawn into the wood of the tree with the advancing season; so that before the leaves fade they have lost the larger part of what was most valuable in them, which the tree retains for its future use. In some of these investigations on the leaves of the beech-tree, it was shown that in their water-free substance the highest 'percentage amount' of nitrogen, phosphoric acid, and potash, is found when they open or expand in the month of May, and this percentage quite regularly decreases till they ripen and fall; but the absolute amount of nitrogen, phosphoric acid, and potash, is greatest in July, and from that time on decreases.

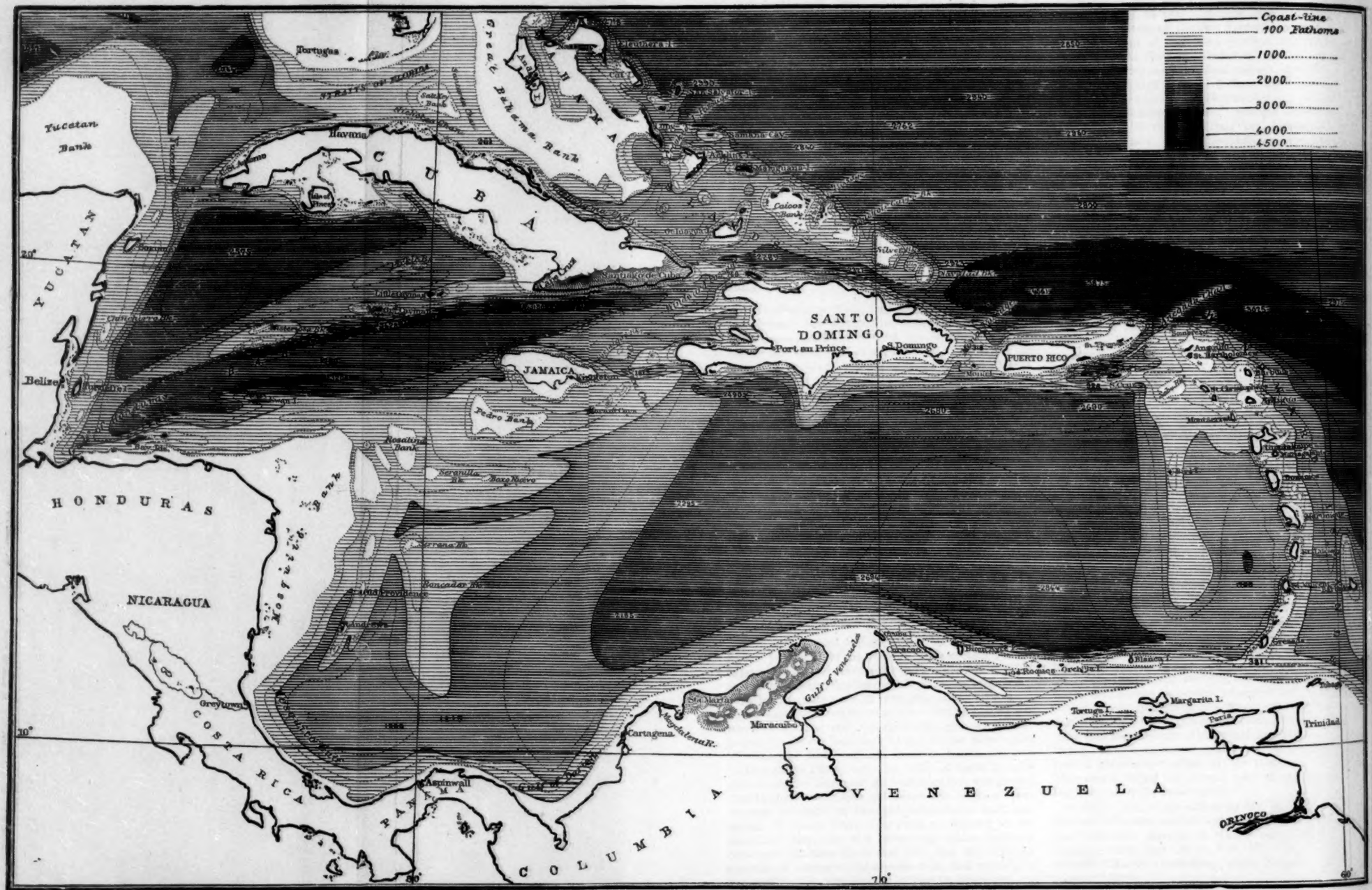
— Mr. I. Millard Reade, C.E., F.G.S., in his presidential address to the Liverpool geological society on the denudation of the two Americas, showed that 150,000,000 tons of matter in solution are annually poured into the Gulf of Mexico by the Mississippi. This, it was estimated, would reduce the time for the denudation of a foot of land over the whole basin from a foot in six thousand years to a foot in forty-five hundred years. Similar calculations were applied to the La Plata, the Amazons, and the St. Lawrence, Mr. Reade arriving at the result that an average of a hundred tons per square mile per annum are removed from the whole American continent. This agrees with results he previously arrived at for Europe: the whole drainage into the Atlantic, if reduced to twenty kilometres at two tons to the cubic yard, would equal a cubic mile every six years.

— The nectar secretion from Aphides is a well-known product. In many cases, however, notably the larch plant-louse, the lice so mimic the twigs on which they rest, that their presence is hard to detect, especially as the lice are often confined to the upper branches of the trees. Often this nectar is secreted so abundantly, that the leaves, and the grass beneath the trees, are covered at early morning by drops so large that it is easy to collect a considerable quantity of the nectar. Sufficient of this nectar can be secured directly from the larch lice and the elm cock's-comb gall lice to test it. Bees are also known to gather it in large quantities. This Aphis nectar is very pleasant and wholesome, and unquestionably forms at times no inconsiderable portion of our most beautiful honey. Such honey is light-colored, pleasing to the taste, and perfectly safe as a winter food for bees. The truth of this statement is sustained by the fact that the bees work freely on such nectar, even though the flowers are yielding abundant nectar at the same time. The bees themselves practically proclaim the excellence of this Aphis nectar.

— The Royal observatory of Brussels has issued the second part of the report upon the transit of Venus of 1882. Two parties were sent out by the Belgian government, one of which located at San Antonio, Tex.; the other, at Santiago, Chili. This portion of the report contains a brief narrative of the experiences of each party, and the detailed observations which were made. The positions of Venus on the disk were determined solely by micrometric observations, which were successfully made at both stations, though clouds materially interfered with the work at San Antonio. Observations for time, latitude, longitude, and meteorological observations, are also given, and a chart is appended containing sketches of the optical phenomena noted at the times of contact. This report forms the second part of volume v. of the 'Annals of the observatory.'

— In No. 101, in the article by Mr. W. C. Winlock, entitled 'Comets and asteroids of 1884,' the date of the perihelion passage of Wolf's comet should be changed from Sept. 26 to Nov. 17. The name of asteroid (237) is 'Coelestina,' while 'Hypatia' is the name of (238).





United-States Hydrographic Office, January, 1885.

THE BASIN OF THE CARIBBEAN.

SCIENCE, January 30, 1885